UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

INSTALLATION AND SAMPLING OF OBSERVATION WELLS AND ANALYSES OF WATER FROM THE SHALLOW AQUIFER AT SELECTED WASTE-DISPOSAL SITES IN THE MEMPHIS AREA, TENNESSEE

By W. S. Parks, D. D. Graham, and J. F. Lowery

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GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

U.S. Geological Survey
A-413 Federal Building
U.S. Courthouse
Nashville, Tennessee 37203

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CONVERSION FACTORS

Factors for converting inch-pound units to International System of Units (SI) are shown to four significant digits.

Multiply	By	To obtain
inch (in)	25.4*	millimeters (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
gallons per minute (gal/min)	6.309×10^{-5}	cubic meter per second (m^3/s)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)

*Exact value

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By W. S. Parks, D. D. Graham, and J. F. Lowery

ABSTRACT

Observation wells were installed and sampled at six abandoned waste-disposal sites in the Memphis area that have been identified as having received unknown quantities and types of industrial wastes. These sites are: (1) Bellevue Dump, (2) Brooks Road Dump, (3) Hollywood Dump, (4) Jackson Pit Dump, (5) Millington Dump-Landfill, and (6) Old Ordnance Dump. Ten wells were installed adjacent to and downgradient from these sites in the shallow water-table aquifer. This aquifer is made up chiefly of the alluvium and fluvial (terrace) deposits of Quaternary age, but locally may include sand in the uppermost part of the Jackson Formation and Claiborne Group of Tertiary age.

Water samples were collected from these 10 wells and from two other wells in the shallow water-table aquifer at the Hollywood Dump. Most wells were sampled twice--initially in the early summer when water levels were high and again in the fall when water levels were low. Other wells were sampled only once in either summer or fall. The water was analyzed for common constituents, selected trace constituents, and selected organic compounds.

INTRODUCTION

The City of Memphis depends solely on ground water for its water supply. Of inventoried pumpage in the Memphis area, which totaled about 193 Mgal/d in 1980, about 97 percent is from the Memphis Sand of the Claiborne Group and 3 percent is from the Fort Pillow Sand of the Wilcox Group. Table 1 shows the post-Midway geologic units underlying the Memphis area and their environmental significance.

The Memphis Sand is believed to be separated from the shallow water-table aquifer (alluvium and fluvial deposits) by a relatively thick and wide-spread confining bed consisting chiefly of clay (Jackson Formation and upper part of Claiborne Group). Studies by the Geological Survey, however, have indicated that part of the recharge to the Memphis Sand is derived by vertical leakage from the shallow water-table aquifer by an exchange of water through the confining bed, or by water moving through local "windows" of sand in the confining bed. These "windows," if located beneath a possible source of contamination, could also provide a pathway through which any contaminants in the shallow water-table aquifer might enter the Memphis Sand (See Criner and others, 1964, p. 30; Bell and Nyman, 1968, p. 7-8; Parks and Lounsbury, 1976, p. 26-27).

Table 1.--Post-Midway geologic units underlying the Memphis area (Modified from Parks and Lounsbury, 1976)

System	Series	Group	Stratigraphic unit	Thickness (ft)
Quaternary	Holocene and Pleistocene		Alluvium	0-175
	Pleistocene		Loess	0-65
Quaternary and Tertiary (?)	Pleistocene and Pliocene (?)		Fluvial deposits (terrace deposits)	0-100
Tertiary	Eocene	?	Jackson Formation and upper part of Claiborne Group ("capping clay")	0-350
		Claiborne	Memphis Sand ("500-foot" sand)	500-880
		Wilcox	Flour Island Formation	160-350
	?		Fort Pillow Sand ("1400-foot" sand)	210-280
	Paleocene		Old Breastworks Formation	200-300

and their environmental significance

Lithology and environmental significance
Sand, gravel, silt, and clay. Provides borrow material for fills and levees and some aggregates for concrete and bituminous mixes. Used as foundation material or base on which fill is placed for residences and light buildings in alluvial plains. Lower sand and gravel beneath Mississippi Alluvial Plain used as foundation material for heavy structures. Alluvial plains of Wolf River, Nonconnah Creek, and Big Creek once used for waste disposal. Supplies water to a few industrial wells on Presidents and Mud Islands.
Silt, silty clay, and minor sand. Used generally as foundation material for residences and light buildings in upland areas. Provides material for fills placed in low places and flood plains. Thick deposits utilized for waste disposal.
Sand and gravel; minor ferruginous sandstone and clay. Provides most commercial aggregates for concrete and bituminous mixes. Used as a foundation material for heavy structures and high-rise buildings in upland areas. Some abandoned gravel pits utilized for waste disposal. Supplies water to many shallow domestic wells in suburban and county areas.
Clay, fine-grained sand, and lignite. Used as foundation material for heavy structures and high-rise buildings where overlying fluvial deposits are thin or absent and where alluvial materials are unsuitable. Supplies water to some shallow wells completed in sands below the fluvial deposits, but generally considered to be of low permeability and to confine water in Memphis Sand. Lower boundary very poorly defined.
Fine- to coarse-grained sand; subordinate lenses of clay and lignite. Very good aquifer from which most water for public and industrial supplies at Memphis is obtained. Upper boundary very poorly defined.
Clay, fine-grained sand, and lignite. Confines water in Memphis Sand and Fort Pillow Sand.
Fine- to medium-grained sand; subordinate lenses of clay and lignite. Once used as second principal aquifer for Memphis; now reserved for future use. Presently supplies water to a few industrial wells at Memphis and to public system in eastern Arkansas and northern Mississippi.
Clay, fine-grained sand, and lignite. Relatively impermeable lower confining bed for water in Fort Pillow Sand.

Additional evidence of vertical leakage being a component of recharge to the Memphis Sand was provided during the calibration of a digital computer model of the aquifers in the Memphis area. For this calibration a leakage factor, averaging about 20 percent over the entire Memphis area (1,300 mi^2), had to be applied to the model in order to simulate known historic water levels in the Memphis Sand (J. V. Brahana, 1980, oral commun.). This new information has increased public concern about the possibility of contaminants being in the shallow water table aquifer, and thus, the potentiality for contaminants to enter the Memphis Sand.

Areas where the shallow water-table aquifer would be most susceptible to contamination are those that have been or are being used for waste disposal. Historically, Memphis and Shelby County along with commercial establishments and industries have used dumps and landfills in two geologically and topographically different areas--the flood plains of nearby streams and abandoned gravel pits in upland areas. These dumps and landfills have received a large variety of wastes including ashes, construction and demolition materials, garbage, rubbish, street refuse, and industrial wastes. Most of these dumps and landfills were closed in the early 1970's at the beginning of state regulation of waste disposal practices. Nevertheless, leachates from these waste disposal facilities presumably have been and are entering the shallow water-table aquifer.

Although water-quality analyses are available for many wells in the shallow water-table aquifer, no specific investigation has been made to determine the quality of the water in this aquifer at potential sources of contamination such as abandoned water-disposal sites.

PURPOSE AND SCOPE

The purpose of this investigation was to collect data on the chemical character of ground water in the shallow water-table aquifer at several abandoned waste-disposal sites in the Memphis area. Major elements in this investigation are to:

(1) install observation wells in the shallow water-table aquifer downgradient from selected waste-disposal sites, develop these wells, and collect water samples for analysis;
(2) analyze the samples to determine the general quality of the ground water and the presence or absence and quantities of certain contaminants, including selected trace constituents and organic compounds; and
(3) prepare a report to describe the methods and procedures used in installing and sampling the wells and give the results of the analyses.

Because of an interest in the early results from this investigation by the public and various governmental agencies, an interim report was prepared by Parks and others (1981) to give the details of the installation and initial sampling of the first eight wells that were installed. The present report updates the interim report in that it gives details concerning all 10 wells that were installed and the analyses for all water samples collected from the shallow water-table aquifer. The analyses of water from two industrial wells in the Memphis Sand are given in the interim report and are not repeated here.

WASTE DISPOSAL SITES UNDER INVESTIGATION

Six waste-disposal sites in the Memphis area have been identified as having received unknown quantities and types of industrial wastes (Waste Age, 1979, p. 54, 56). These sites are the (1) Bellevue Dump, (2) Brooks Road Dump, (3) Hollywood Dump, (4) Jackson Pit Dump, (5) Millington Dump-Landfill, and (6) Old Ordnance Dump. Figure 1 shows the locations of the six waste-disposal sites under investigation with respect to the major cone of depression in the Memphis Sand; figures 2 through 6 show the specific locations of these sites and the wells installed or sampled.

Bellevue Dump

The Bellevue Dump is in north Memphis south of the Wolf River between North Watkins Street on the east and Cypress Creek on the south and west (fig. 2). This dump occupies an excavation in the alluvial plain of the Wolf River made by dredging during the mining of sand.

Surface-water drainage from the dump is to the northwest into a residual lake left by the sand mining operation and north into the Wolf River. Water flows from the Wolf River into the residual lake at rising stages, but from the lake into the Wolf River during falling stages. Surface-water drainage is restricted towards the east by the fill for North Watkins Street and towards the southeast by the levee for Cypress Creek. The Wolf River flows from east to west just north of the dump.

The direction of ground-water flow in the water-table aquifer may be in almost any direction inasmuch as the dump is higher than most surrounding areas. However, the principal direction of ground-water flow from a large part of the dump is presumed to be to the northwest in the principal direction of surface-water drainage.

Well Sh:O-230 was installed on the northwest side of the dump. The auger hole for the well penetrated, from land surface to total depth, about 19 feet of fill and refuse, 5 feet of silt, and 7.5 feet of fine to medium sand. The hole was terminated at 31.5 feet in Wolf River alluvium.

Brooks Road Dump

The Brooks Road Dump is in south Memphis between Nonconnah Creek on the north and Brooks Road on the south, about 0.5 to 1 mile east of U.S. Highway 61 (fig. 3). This dump was made on the alluvial plain of Nonconnah Creek and consists of two parts--east and west segments--separated by about 0.2 mile.

Surface-water drainage is into ditches that surround most of both segments of the dump. These ditches discharge into Nonconnah Creek which flows from east to west just north of the dump.

The direction of ground-water flow in the water table aquifer can be presumed to be in two general directions--northward from the high areas south of the dump towards Nonconnah Creek and westward down Nonconnah Creek valley. The vector of these two general directions is towards the northwest, which is presumed to be the principal direction of ground-water flow beneath the dump.

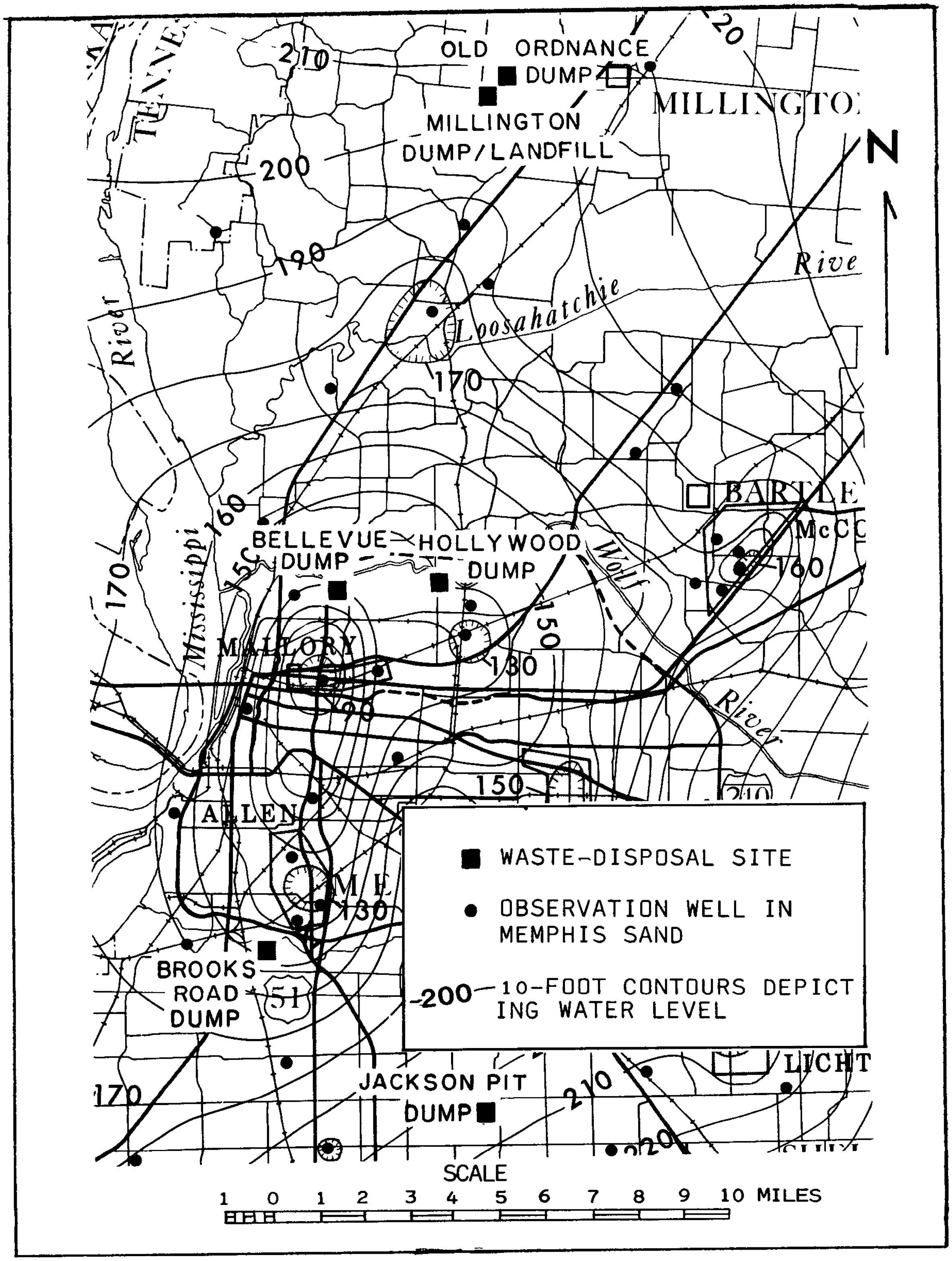
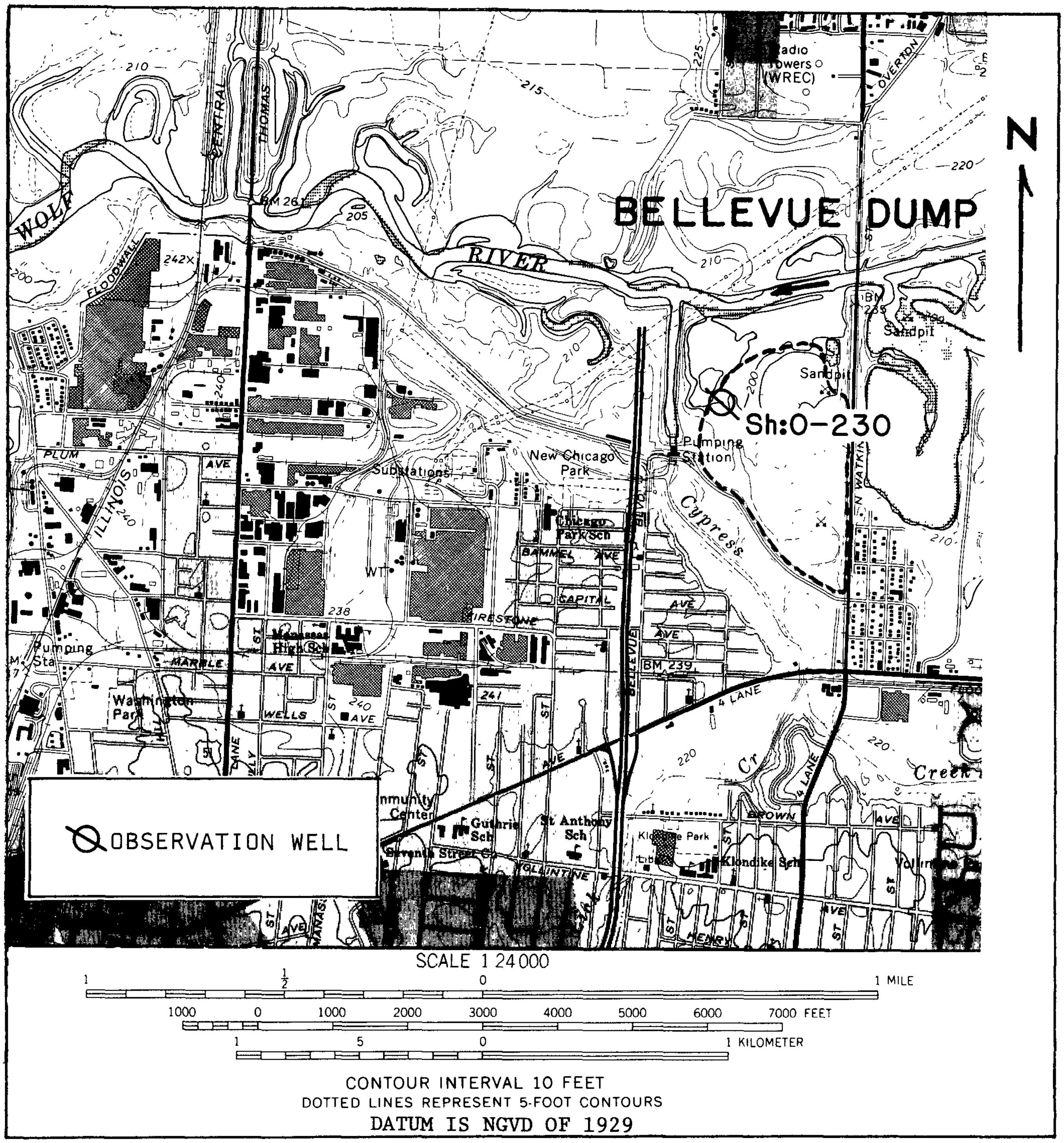
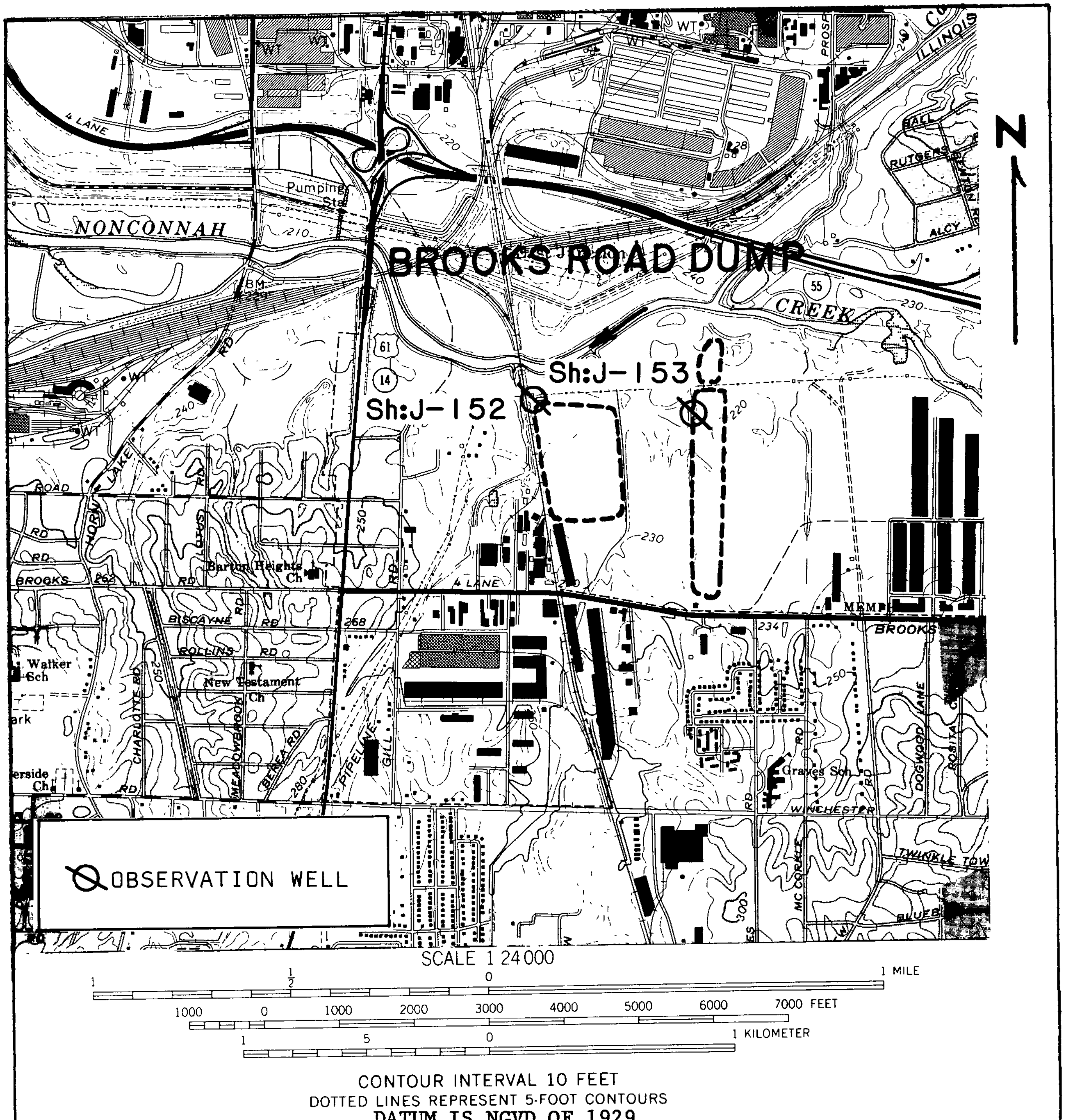


Figure 1.--Location of the six abandoned waste-disposal sites under investigation with respect to the major cone of depression in the Memphis Sand at Memphis, Tenn. Contours indicate the altitude at which water levels would have stood in tightly cased wells in the Memphis Sand in August 1978. (From Graham, 1979).



Base from U.S. Geological Survey
Northwest Memphis, 1965
Interim revision as of 1973

Figure 2.--Location of the Bellevue Dump and well installed and sampled.



Base from U.S. Geological Survey
Southwest Memphis, 1965
Interim revision as of 1973

Figure 3.--Location of the Brooks Road Dump and wells installed and sampled.

Well Sh:J-152 was installed at the northwest corner of the west segment of the dump. The auger hole for this well penetrated about 16.5 feet of silty clay, 10.5 feet of silty sand and gravel, and 2.5 feet of fine sand. The hole was terminated at 29.5 feet in Nonconnah Creek alluvium.

Well Sh:J-153 was installed on the west side of the northern extension of the east segment of the dump. The auger hole for this well penetrated about 13 feet of silty clay, 7 feet of sandy silt, and 14 feet of gravelly sand. The hole was terminated at 34 feet in Nonconnah Creek alluvium.

Hollywood Dump

The Hollywood Dump is in north Memphis on both sides of Hollywood Street just south of the Wolf River (fig. 4). This dump was made in abandoned channels and on the alluvial plain of the Wolf River.

Surface water drains from the dump into several ditches along its margins. These ditches in turn discharge into nearby low areas and lakes or into the Wolf River which flows east to west just north of the dump.

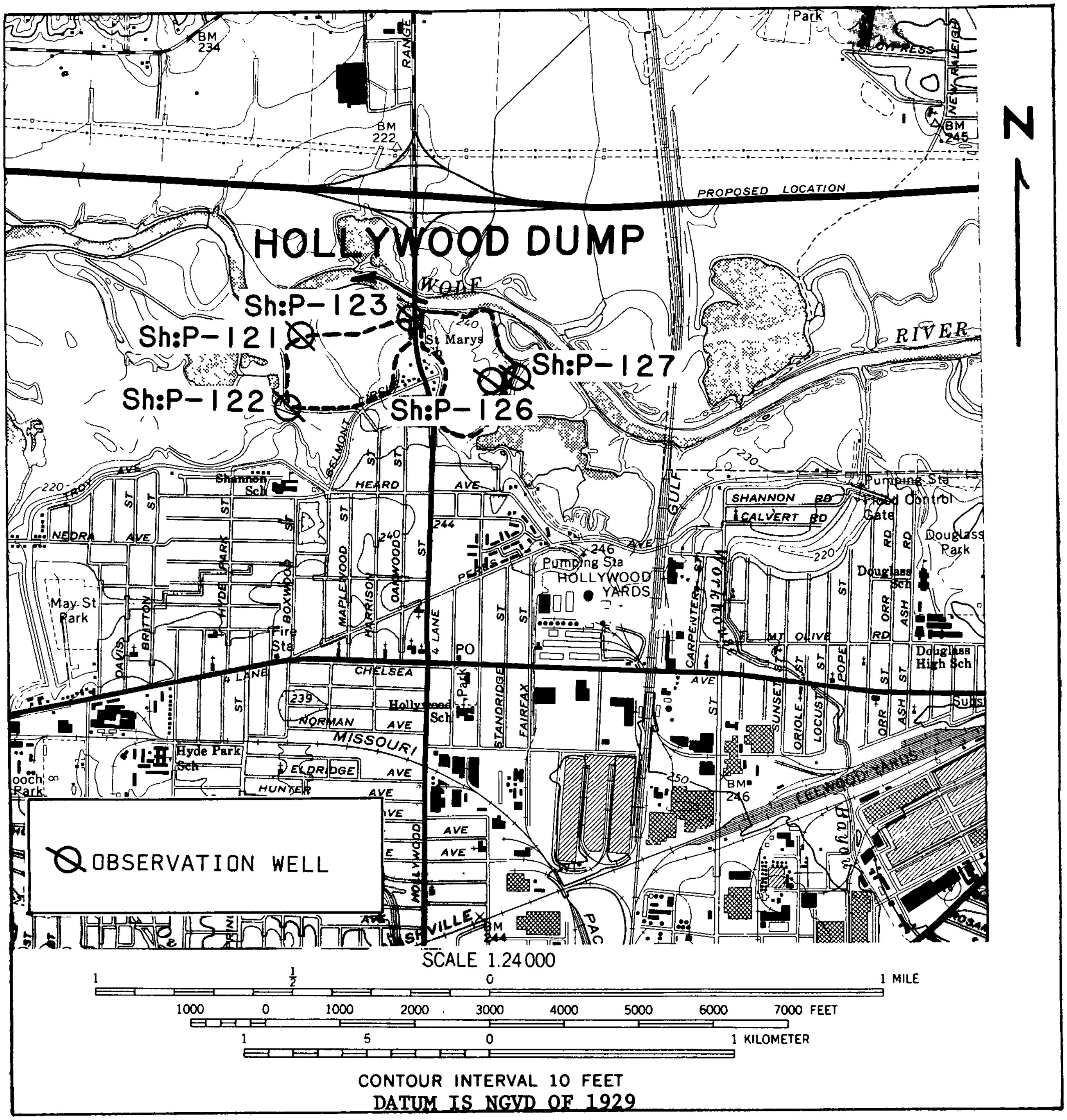
The direction of ground-water flow in the water-table aquifer can be presumed to be in two general directions--northward from the original high ground south of the dump towards the Wolf River and westward down the Wolf River valley. The vector of these two general directions is towards the northwest, which is presumed to be the principal direction of ground-water flow beneath the dump.

Well Sh:P-121 was installed near the northwest corner of the dump in an area where barrels containing pesticide residue had been buried at depths of a few feet. These barrels were removed just prior to installing the well. The auger hole for this well penetrated about 18 feet of silty clay, 6 feet of sand and gravel, and 1 foot of silty fine sand. The hole was terminated at 25 feet in Wolf River alluvium.

Well Sh:P-122 was installed near the southwest corner of the dump adjacent to the so-called "endrin pit," where pesticide residue is reported to have been buried. The auger hole for this well penetrated about 6 feet of silty clay and fill or refuse, 4 feet of sandy clay, 5 feet of silty sand, and 5 feet of fine to medium sand. The hole was terminated at 20 feet in Wolf River alluvium.

Well Sh:P-123 was installed near the north edge of the dump just west of the Hollywood Street bridge across the Wolf River. The auger hole for this well penetrated 8.5 feet of fill or refuse, 11.5 feet of silty sand, and 10 feet of fine to medium sand. The hole was terminated at 30 feet in Wolf River alluvium.

Well Sh:P-126 was installed by the Tennessee Valley Authority (TVA) on the east side of the eastern part of the dump. According to TVA, the auger hole for this well penetrated 22 feet of fill and 8 feet of sand. The hole was terminated at 30 feet in Wolf River alluvium.



Base from U.S. Geological Survey
Northeast Memphis, 1965
Interim revision as of 1973

Figure 4.--Location of the Hollywood Dump and wells installed or sampled.

Well Sh:P-127 was also installed by TVA just east and across a drainage ditch from the eastern margin of the dump. According to TVA, the auger hole for this well penetrated 8 feet of sandy silt and 18.5 feet of silty sand. The hole was terminated at 26.5 feet in Wolf River alluvium.

Jackson Pit Dump

The Jackson Pit Dump is in southeast Memphis near Memphis International Airport on the south side of Whitehaven-Capleville Road (Shelby Drive), about 0.5 mile west of Tchulahoma Road (fig. 5). This dump occupies an abandoned gravel pit in which the loess was removed as overburden to mine sand and gravel in the fluvial deposits.

Surface water from the dump drains westward into Hurricane Creek. The dump is separated into north and south segments by a small tributary of Hurricane Creek. This small tributary, which flows east to west, receives surface-water drainage from a large part of both segments. Hurricane Creek flows northward about 0.2 mile west of the dump.

The direction of ground-water flow in the water-table aquifer is locally complicated because of a variable topography and geology. The general direction of ground-water flow, however, is presumed to be westward and northward following the general pattern of surface-water drainage.

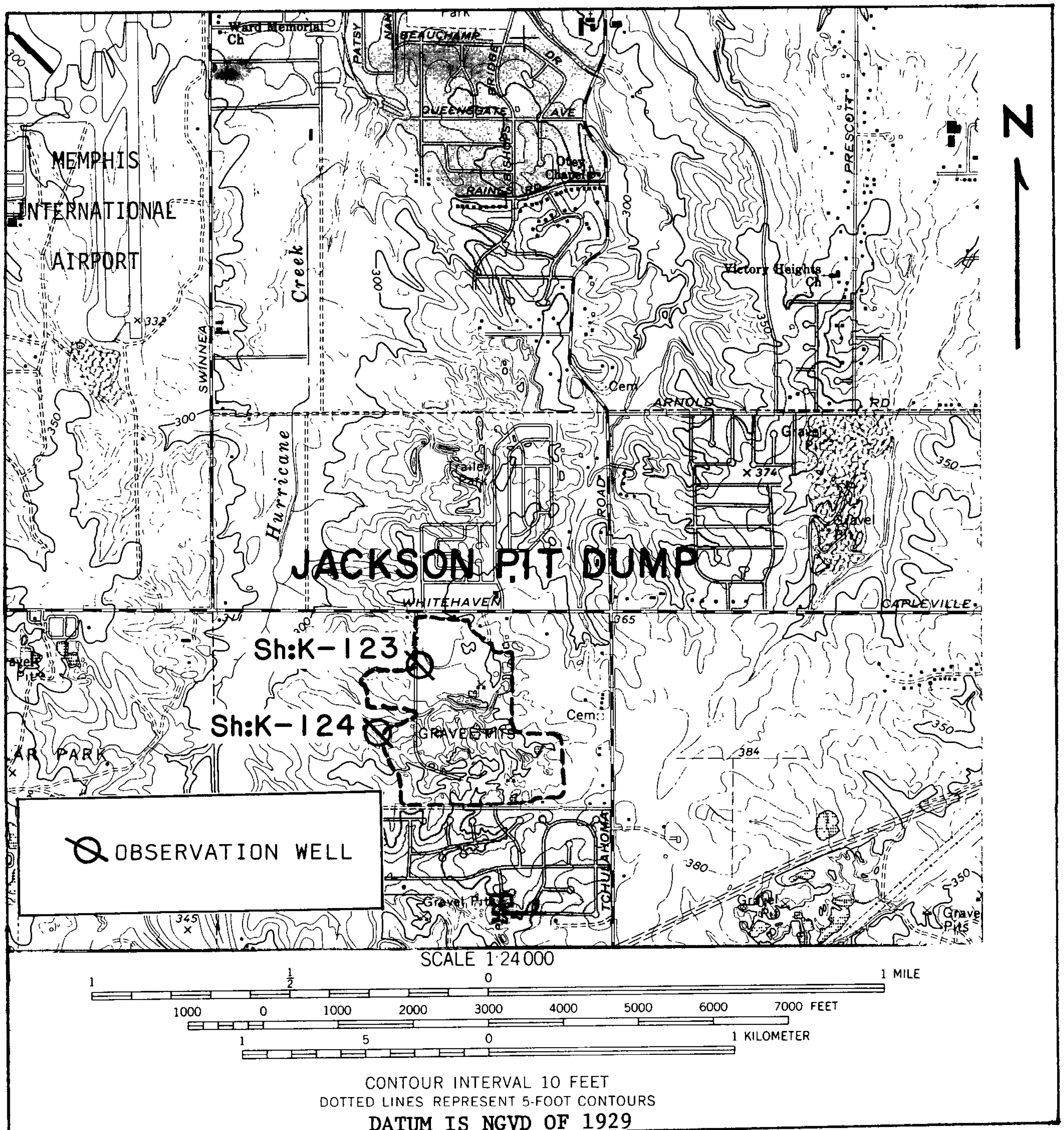
Originally, it was planned to complete the wells at the Jackson Pit Dump in the sand and gravel of the fluvial deposits which, along with the alluvium, make up the shallow aquifer in the area. This geologic unit was thin or absent in the places augered. Consequently, the wells were screened in a fine silty sand in the uppermost part of the Jackson Formation and Claiborne Group, which underlies the fluvial deposits.

Well Sh:K-123 was installed on the west side of the north segment. The auger hole for this well penetrated at least 9 feet of fill, 20 feet with no returns from the auger (probably fill and fluvial deposits), and 10 feet of silty fine sand. The hole was terminated 39 feet in the Jackson Formation or upper part of the Claiborne Group.

Well Sh:K-124 was installed on the west side of the south segment of the dump. The auger hole for this well penetrated about 10.5 feet of silty clay (loess), 2 feet of clayey gravel (fluvial deposits), and 4.5 feet of silty clay and 27 feet of silty fine sand. The hole was terminated at 44 feet in the Jackson Formation or upper part of the Claiborne Group.

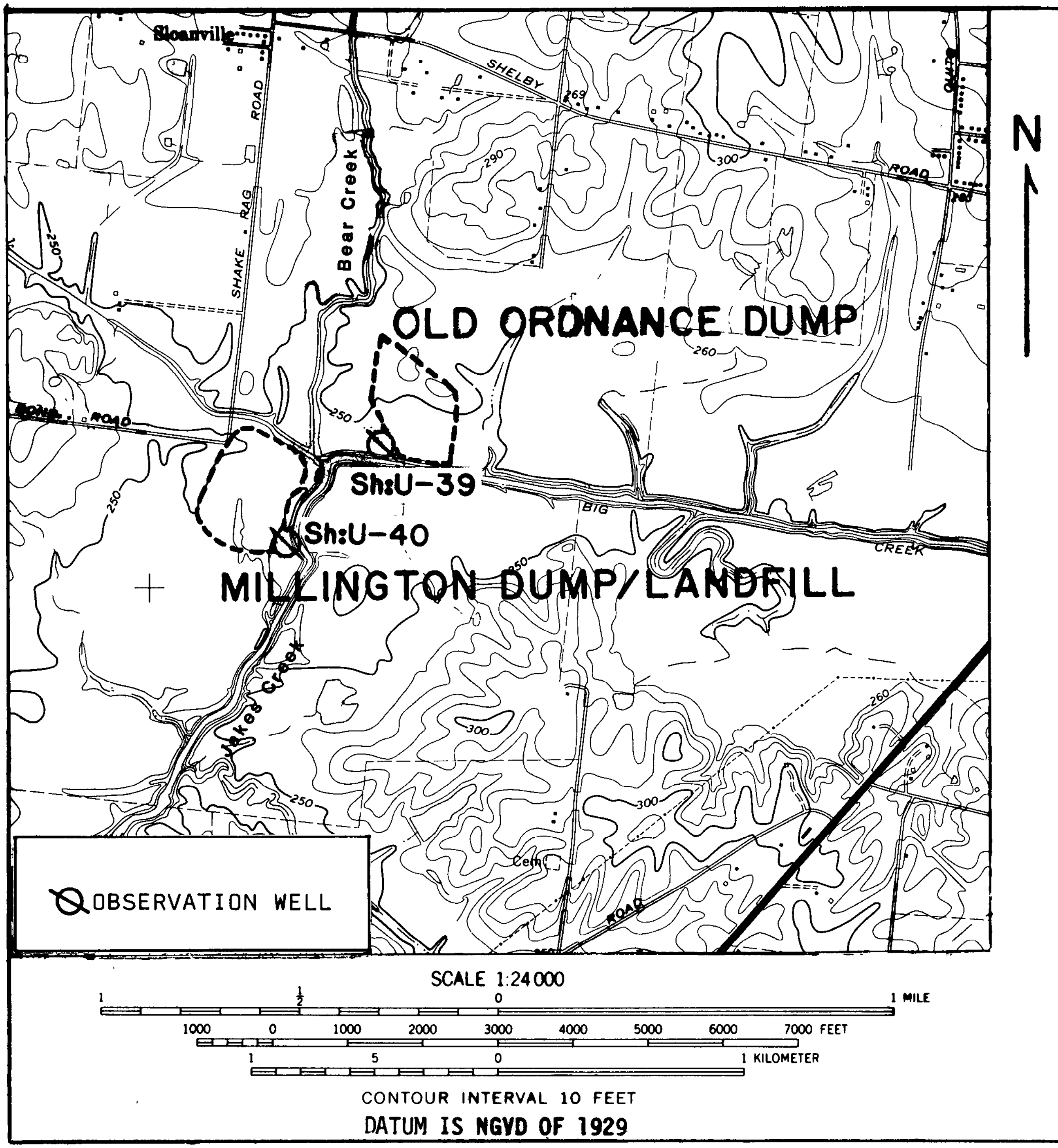
Millington Dump-Landfill

The Millington Dump-Landfill is in northwestern Shelby County just southeast of the corner made by the junction of Shake Rag and Bond Roads, about 1 mile south of Sloanville (fig. 6). This dump was made on the alluvial plains of Big Creek and Jakes Creek, just south of their confluence.



Base from U.S. Geological Survey
Southeast Memphis, 1965
Interim revision as of 1973

Figure 5.--Location of the Jackson Pit Dump and wells installed or sampled.



Base from U.S. Geological Survey
Millington, Tenn., 1971

Figure 6.--Location of the Millington Dump/Landfill and Old Ordnance Dump and wells installed and sampled.

Surface-water drainage from this dump is westward into Big Creek Drainage Canal and northward into Jakes Creek. Most of the drainage into Big Creek is through a ditch along the south side of the dump. Big Creek flows from north to south just east of the dump.

The direction of ground-water flow in the water-table aquifer can be presumed to be in two general directions--southeastward down Jakes Creek valley and southwestward down Big Creek valley. The vector of these two directions is towards the south, which is presumed to be the principal direction of ground-water flow beneath the dump.

Well Sh:U-40 was installed at the southeast corner of the dump near Big Creek Drainage Canal. The auger hole for this well penetrated 3.5 feet of silt, 42.5 feet of silty clay, and 14 feet of silty fine sand. The hole was terminated at 60 feet in Big Creek alluvium.

Old Ordnance Dump

The Old Ordnance Dump is in northwestern Shelby County just north of Big Creek Drainage Canal and east of Bear Creek near the site of the long-abandoned Chickasaw Ordnance Works (fig. 6). This dump was made on the alluvial plain of Big Creek, about 0.2 mile upstream from its confluence with Bear Creek.

Surface-water drainage from the dump is southward into Big Creek Drainage Canal, largely through ditches made for agricultural purposes. Big Creek flows from east to west just south of the dump.

The direction of ground-water flow in the water-table aquifer can be presumed to be in two general directions--southward from the high ground north of the dump and westward down Big Creek valley. The vector of these two directions is towards the southwest, which is presumed to be the principal direction of ground-water flow beneath the dump.

Well Sh:U-39 was installed just southwest of the dump. The auger hole for this well penetrated 3 feet of clayey silt, 22 feet of silty clay, and 30 feet of sand with scattered small gravel. The hole was terminated at 55 feet in Big Creek alluvium.

WELL INSTALLATION

The hollow-stem auger method of drilling was selected instead of the hydraulic rotary method to avoid the introduction of water and drilling mud into the shallow aquifer. Stainless steel was selected as the material for the well points (screens) and casing instead of polyvinyl chloride (PVC) to avoid exposure of the water to be sampled to organic compounds.

Figure 7 is a schematic diagram showing the construction plan used for the shallow wells. The general procedures followed in installing each well are as follows:

(1) the hollow auger stem was cleaned inside and outside by spraying with reagent-grade isopropyl alcohol using a stainless-steel garden sprayer;

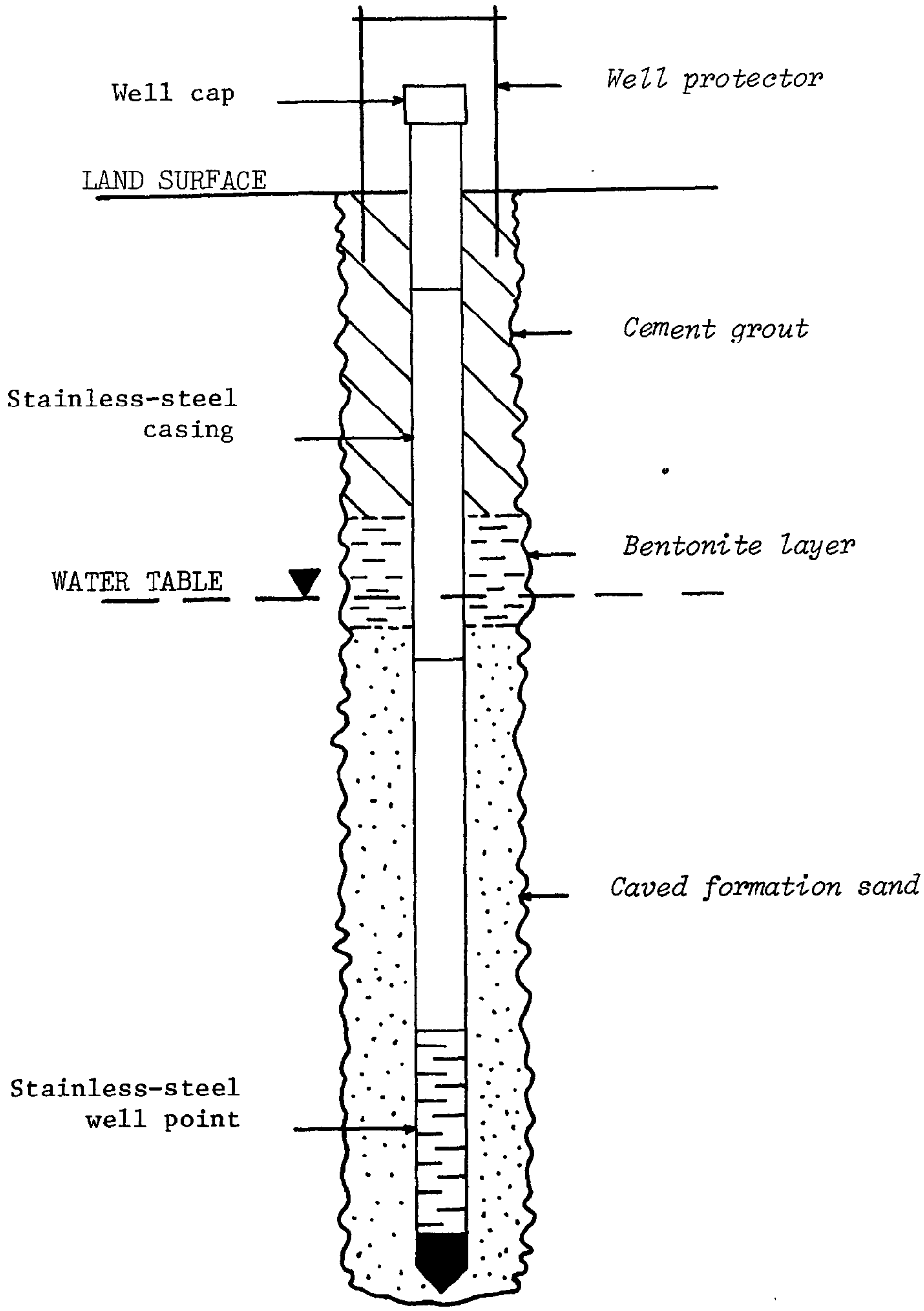


FIGURE 7.--Schematic diagram showing the construction of the wells.

(2) a hole was augered to the first water-bearing sand or to a depth necessary to penetrate a sand or sandy material in which the well point could be set;
(3) the water level was measured through the hollow auger-stem to insure that the top of the well point was a least 10 feet below the static water table;
(4) a 5-foot, 2-inch diameter stainless-steel well point (slot size 0.010 inch) attached to the needed amount of 2-inch diameter stainless-steel casing was lowered through the hollow auger-stem and pushed out the bottom;
(5) the auger stem was carefully removed from the auger hole, leaving the well point and casing set at the desired depth and the top of the casing at about a foot above land surface;
(6) the annular space around the casing was probed to determine the depth to which sand had caved around the well point and casing, which generally was found to be about the level of the water table;
(7) an amount of 1/2-inch diameter bentonite pellets to make a 3-foot layer or more was poured into the annular space around the casing to seal the well above the caved sand;
(8) a mixture of sand and cement (cement grout) was slowly poured into the remaining annular space around the casing to seal the well above the bentonite layer to land surface;
(9) a well protector, consisting of a 30-inch length of 10-inch diameter steel pipe with a lockable steel plate on top, was seated in the cement grout; and
(10) the well was capped, the well protector locked, and the drilling site was cleaned up.

Deviations from the above general procedures in installing individual wells are:

(1) well Sh:0-230 at the Bellevue Dump was constructed by using 15.9 feet of galvanized-steel pipe in its upper part,
(2) well Sh:P-122 at the Hollywood Dump had no bentonite pellets placed between the formation sand and the cement grout because the sand caved to within 2.4 feet of land surface, and
(3) well Sh:U-40 at the Millington Dump-Landfill was constructed by using 18 feet of galvanized-steel pipe in its upper part and a 4-foot stainless-steel well point.

In selecting locations for the 10 shallow wells, care was taken to locate them off the main dump areas. Nonetheless, several holes unavoidably were augered through fill or refuse.

WELL DEVELOPMENT

Before sampling, the wells required development to increase yields and to clear the water of formation sediment. Two methods of well development were used, depending on the depths to water and the character of the aquifer materials screened. In general, these two well development techniques consisted of (1) surging and pumping the well at the highest rate possible using a centrifugal pump or (2) injecting and surging air through the screen using an air compressor. Table 2 gives details concerning the 10 shallow wells installed for this project, including the technique and duration of well development used.

Table 2.--Records of observation wells installed in the shallow aquifer at selected waste-disposal sites

Well No.	Date drilled	Altitude[1] (ft)	Screen setting below land surface datum (ft)	Water level below land surface datum: Depth (ft)	Water level below land surface datum: Date	Well development time: compressed air (hr)	Well development time: centrifugal pump (hr)	Measured or estimated(e) yield of well (gal/min)	Time pumped continuously before sampling (hr)
					BELLEVUE DUMP				
Sh:0-230	5-28-80	217.2	25.7-30.7	13.92	6-05-80	none	2	13	2
				14.86	11-05-80	none	1	30	1
					BROOKS ROAD DUMP				
Sh:J-152	5-14-80	216.0	24.4-29.4	13.50	6-20-80	2[2]	6	1	5
				14.47	11-05-80	none	1.25	1	1.25
Sh:J-153	5-14-80	222.0	28.1-33.1	12.50	6-19-80	1.5	2.5	3	2
				14.95	11-05-80	none	0.5	6	0.5
					HOLLYWOOD DUMP				
Sh:P-121	5-28-80	221.5[3]	19.1-24.1	13.25	6-11-80	3	1.5	3	1.5
				14.42	11-05-80	none	1	6.5	1
Sh:P-122	5-13-80	218.0[3]	14.4-19.4	2.34	6-02-80	1[2]	4	23	3
				4.70	11-04-80	none	2	80	2
Sh:P-123	5-12-80	219.5[3]	24.4-29.4	11.89	6-02-80	1[2]	5	15	2
				13.33	11-04-80	none	2	50	2
Sh:P-126	7-24-80	236.0[3]	24.6-29.6	25.45	11-03-80	5	none	0.5 (e)	3
Sh:P-127	9-11-80	218.9[3]	20.8-25.8	7.73	11-03-80	3	2	15	2
					JACKSON PIT DUMP				
Sh:K-123	5-15-80	342.1	32.4-37.6	15.47	6-05-80	4	none	0.5 (e)	0.5
				21.74	11-06-80	none	none	0.25	2
Sh:K-124	5-27-80	343.4	38.2-43.2	25.88	6-05-80	4	none	0.5 (e)	0.5
				27.80	11-06-80	none	none	0.02(e)	3
					MILLINGTON DUMP-LANDFILL				
Sh:U-40	7-20-81	245[4]	55.4-60.4	27.74	7-24-81	6	none	0.02(e)	0.5
					OLD ORDNANCE DUMP				
Sh:U-39	6-22-81	245[4]	48.6-53.6	25.73	7-09-81	5	none	0.25	2

[1] Altitude above National Geodetic Vertical Datum of 1929: A geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada, formerly called "Mean Sea Level."

[2] Additional well development after initial sampling.

[3] Adjusted to land-surface datum from survey of altitudes of top of well protector by the Tennessee Valley Authority (except for P-127 which was surveyed to land-surface datum).

[4] Interpolated from Millington, Tenn., (1971) topographic map (scale 1:24,000; contour interval, 10 feet).

Wells Sh:O-230, Sh:P-122, and Sh:P-123 had water levels and yields high enough to permit well development by pumping with a centrifugal pump. Although this method was effective in clearing the water of sediment, additional sediment re-entered the well in a short period of time after pumping ceased. After initial sampling, wells Sh:P-122 and Sh:P-123 were additionally developed using compressed air in hopes that development would be adequate for the second sampling.

Wells Sh:J-152, Sh:J-153, and Sh:P-121 had water levels high enough for pumping with a centrifugal pump, but the formation materials screened were too tight to give up enough water for pumping. Wells Sh:J-152 and Sh:J-153 were developed by backflushing with clear water and then with compressed air. Water used for this purpose was taken from the city's water supply system to avoid introduction of contaminants into the aquifer. Well Sh:P-121 was developed with compressed air. After development, all three wells were pumped with a centrifugal pump.

Wells Sh:K-123, Sh:K-124, and Sh:U-40 had water levels and yields too low to develop using a centrifugal pump. These wells were screened in silty fine sand, much of which was finer than the slot size selected for the screens (0.010 inch). Well Sh:U-39 was screened in a sand having potential for a relatively good yield, but the water level was too low for pumping with a centrifugal pump. These wells required an extended period of development using compressed air.

SAMPLING PROCEDURES

Water samples for analysis were collected from each of the 12 shallow wells at the end of a pumping period which followed or included well development. The length of this pumping period varied depending on the individual characteristics of the well and the technique of well development. Table 2 gives the length of the period continuously pumped before each well was sampled.

Wells Sh:J-152, Sh:J-153, Sh:O-230, Sh:P-121, Sh:P-122, Sh:P-123, and Sh:P-127 had water levels and yields high enough to sample by pumping with a centrifugal pump. These wells were pumped for the period of time thought necessary to insure well development and to clear the water of formation sediment. Wells Sh:K-123, Sh:K-124, Sh:P-126, Sh:U-39, and Sh:U-40 had water levels or yields too low to pump with a centrifugal pump. These wells were cleared of as much sediment as possible during well development with compressed air and then were additionally evacuated using a squeeze-type pump of low capacity (about 0.5 gal/min) before sampling.

Temperature and specific conductance were measured periodically during the pumping period of all wells to insure that these parameters had stabilized before sampling. All bottles and sampling equipment were washed or thoroughly rinsed with water from the well to be sampled. When the squeeze-type pump was used, this equipment was rinsed with reagent-grade isopropyl alcohol and then rinsed with deionized water before sampling.

Water samples to be analyzed for common constituents and selected trace constituents were taken from the discharge of the pumps (either centrifugal or squeeze-type). Samples to be analyzed for selected organic compounds were taken from the well at a level within or just above the screen using a nickel-coated brass bailer designed for sampling wells.

Water-quality parameters measured in the field were temperature, specific conductance, pH, and alkalinity. Water samples for laboratory analysis were collected in plastic or glass bottles, labeled, and treated as required according to standard U.S. Geological Survey procedures. These bottles were chilled in ice chests which were sealed with fiber tape and shipped on the day of sampling to the laboratory.

Wells Sh:J-152, Sh:J-153, Sh:K-123, Sh:K-124, Sh:O-230, Sh:P-121, Sh:P-122, and Sh:P-123, installed during the first year of the project, were sampled in the early summer of 1980 when water levels were high and again in the fall of 1980 when water levels were low. Wells Sh:P-126 and Sh:P-127, installed by TVA in the summer of 1980, were sampled in the fall of 1980. Wells Sh:U-39 and Sh:U-40, installed during the second year of the project, were sampled in the summer of 1981.

WATER-QUALITY DATA

Water samples collected for this project were sent to the Geological Survey's Central Laboratory at Atlanta, Ga., for analysis. For most wells, concentrations of common constitutents in ground water, selected trace constituents, and selected organic compounds were determined. The samples from wells Sh:U-39 and Sh:U-40 were additionally analyzed for major munitions products.

Table 3 gives the analyses for water from the 12 shallow wells in the water-table aquifer (includes the 2 TVA wells).

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites

WELL SH:J-152

DATE 1980	SAMP- LING DEPTH (FT)	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH FIELD (UNITS)	TEMPER- ATURE, WATER (DEG C)	COLOR (PLAT- INUM COBALT UNITS)	NITRO- GEN, DIS- SOLVED (MG/L AS N)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD- NESS (MG/L AS CACO3)	HARD- NESS, NONCAR- BONATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MG/L AS CA)
JUN 20...	29.4	1850	6.7	25.0	15	--	<1	K2	490	0	99
NOV 05...	29.0	1700	6.7	26.0	15	19	<1	<1	560	0	110

DATE	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG)	SODIUM, DIS- SOLVED (MG/L AS NA)	POTAS- SIUM, DIS- SOLVED (MG/L AS K)	ALKA- LINITY (MG/L AS CACO3)	SULFATE DIS- SOLVED (MG/L AS SO4)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL)	FLUO- RIDE, DIS- SOLVED (MG/L AS F)	SILICA, DIS- SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N)
JUN 20...	59	150	17	560	20	230	.4	25	1020	957	.16
NOV 05...	70	160	17	590	8.3	270	.2	26	1110	1040	--

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N)	NITRO- GEN, TOTAL (MG/L AS N)	NITRO- GEN, TOTAL (MG/L AS NO3)	PHOS- PHORUS, TOTAL (MG/L AS P)	PHOS- PHORUS, TOTAL (MG/L AS PO4)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P)	ARSENIC DIS- SOLVED (UG/L AS AS)	BARIUM, DIS- SOLVED (UG/L AS BA)	CADMIUM DIS- SOLVED (UG/L AS CD)
JUN 20...	.16	20	--	20	89	.330	1.0	--	6	1000	4
NOV 05...	.03	--	19	--	--	--	--	.010	6	900	5

DATE	CHRO- MIUM, DIS- SOLVED (UG/L AS CR)	COPPER, DIS- SOLVED (UG/L AS CU)	IRON, DIS- SOLVED (UG/L AS FE)	LEAD, DIS- SOLVED (UG/L AS PB)	MANGA- NESE, TOTAL (UG/L AS MN)	MANGA- NESE, DIS- SOLVED (UG/L AS MN)	MERCURY DIS- SOLVED (UG/L AS HG)	NICKEL, DIS- SOLVED (UG/L AS NI)	SELE- NIUM, DIS- SOLVED (UG/L AS SE)	SILVER, DIS- SOLVED (UG/L AS AG)	ZINC, DIS- SOLVED (UG/L AS ZN)
JUN 20...	10	2	15000	0	3500	3400	<.1	19	1	0	70
NOV 05...	3	0	20000	3	--	4300	.1	20	1	0	50

DATE	CARBON, ORGANIC TOTAL (MG/L AS C)	CYANIDE DIS- SOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PER- THANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPH- THA- LENES, POLY- CHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLOR- DANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
JUN 20...	32	.01	0	.20	.0	.00	.00	.0	.00	.0	.00
NOV 05...	27	.00	3	--	--	<.01	<.10	<.1	<.01	7.2	<.01

DATE	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DI- AZINON, TOTAL (UG/L)	DI- ELDRIN TOTAL (UG/L)	ENDO- SULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA- CHLOR, TOTAL (UG/L)	HEPTA- CHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALA- THION, TOTAL (UG/L)
JUN 20...	.00	.00	.04	.00	.00	.00	.00	.00	.00	.00	.00
NOV 05...	<.01	<.01	<.01	.01	<.01	.01	<.01	.01	.01	<.01	<.01

DATE	METH- OXY- CHLOR, TOTAL (UG/L)	METHYL PARA- THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRI- THION, TOTAL (UG/L)	PARA- THION, TOTAL (UG/L)	TOX- APHENE, TOTAL (UG/L)	TOTAL TRI- THION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 20...	.00	.00	.00	.00	.00	0	.00	--	--	--	--
NOV 05...	<.01	<.01	<.01	<.01	<.01	0	<.01	.00	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:J-153

DATE 1980	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)
JUN 23...	33.1	1500	6.2	25.0	0	--	<1	<1	--	--	--	--
NOV 05...	33.0	1500	6.4	22.0	6	3.7	<1	<1	330	0	78	33

DATE	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
JUN 23...	--	4.5	340	.2	240	.2	--	802	--	.01	.01
NOV 05...	170	4.8	390	6.5	250	.1	22	928	863	--	.00

DATE	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC DIS. (MG/L AS N)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, TOTAL (MG/L AS NO3)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, TOTAL (MG/L AS PO4)	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)
JUN 23...	3.0	--	3.0	13	.080	.25	--	3	--	--	--
NOV 05...	--	3.6	--	--	--	--	.020	2	800	14	7

DATE	COPPER, DISSOLVED (UG/L AS CU)	IRON, TOTAL (UG/L AS FE)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, TOTAL (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)
JUN 23...	2	37000	--	0	4000	--	.1	8	1	0	--
NOV 05...	0	--	60000	1	--	4500	.1	8	0	0	0

DATE	CARBON, ORGANIC TOTAL (MG/L AS C)	CYANIDE DISSOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
JUN 23...	38	.01	2	.50	9.0	.00	.00	.0	.00	.1	.00
NOV 05...	22	.01	0	--	--	<.01	<.10	<.1	<.01	.5	<.01

DATE	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)
JUN 23...	.00	.01	.05	.00	.00	.00	.00	.00	.00	.00	.01
NOV 05...	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

DATE	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 23...	.00	.00	.00	.00	.00	0	.00	.00	--	.00	.00
NOV 05...	<.01	<.01	<.01	<.01	<.01	0	<.01	.00	.00	.00	.00

WELL SH:K-123

DATE 1980	SAMP- LING DEPTH (FT)	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH FIELD (UNITS)	TEMPER- ATURE, WATER (DEG C)	COLOR (PLAT- INUM COBALT UNITS)	NITRO- GEN, DIS- SOLVED (MG/L AS N)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD- NESS (MG/L AS CACO3)	HARD- NESS, NONCAR- BONATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MG/L AS CA)
JUN 09...	37.6	2050	6.9	19.0	10	--	<1	K4	610	0	140
NOV 06...	37.0	1900	6.8	19.0	10	73	K1	K1	530	0	120

DATE	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG)	SODIUM, DIS- SOLVED (MG/L AS NA)	POTAS- SIUM, DIS- SOLVED (MG/L AS K)	ALKA- LINITY (MG/L AS CACO3)	SULFATE DIS- SOLVED (MG/L AS SO4)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL)	FLUO- RIDE, DIS- SOLVED (MG/L AS F)	SILICA, DIS- SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N)
JUN 09...	64	170	52	970	28	130	.9	14	1200	.04
NOV 06...	55	180	55	970	19	130	1.1	13	1190	--

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N)	NITRO- GEN, TOTAL (MG/L AS N)	NITRO- GEN, TOTAL (MG/L AS NO3)	PHOS- PHORUS, TOTAL (MG/L AS P)	PHOS- PHORUS, TOTAL (MG/L AS PO4)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P)	ARSENIC DIS- SOLVED (UG/L AS AS)	BARIUM, DIS- SOLVED (UG/L AS BA)	CADMIUM DIS- SOLVED (UG/L AS CD)
JUN 09...	--	23	--	23	100	.050	.15	--	4	700	0
NOV 06...	.01	--	73	--	--	--	--	.010	--	--	--

DATE	CHRO- MIUM, DIS- SOLVED (UG/L AS CR)	COPPER, DIS- SOLVED (UG/L AS CU)	IRON, TOTAL (UG/L AS FE)	IRON, DIS- SOLVED (UG/L AS FE)	LEAD, DIS- SOLVED (UG/L AS PB)	MANGA- NESE, DIS- SOLVED (UG/L AS MN)	MERCURY DIS- SOLVED (UG/L AS HG)	NICKEL, DIS- SOLVED (UG/L AS NI)	SELE- NIUM, DIS- SOLVED (UG/L AS SE)	SILVER, DIS- SOLVED (UG/L AS AG)	ZINC, DIS- SOLVED (UG/L AS ZN)
JUN 09...	14	9	13000	7800	0	8000	.1	17	0	0	0
NOV 06...	6	0	--	23000	0	7900	.2	11	--	0	--

DATE	CARBON, ORGANIC TOTAL (MG/L AS C)	CYANIDE DIS- SOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PER- THANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPH- THA- LENES, POLY- CHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLOR- DANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
JUN 09...	43	.00	1	.30	.0	.00	.20	.0	.00	.2	.00
NOV 06...	--	--	6	--	.9	<.01	<.10	<.1	<.01	.3	<.01

DATE	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DI- AZINON, TOTAL (UG/L)	DI- ELDRIN TOTAL (UG/L)	ENDO- SULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA- CHLOR, TOTAL (UG/L)	HEPTA- CHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALA- THION, TOTAL (UG/L)
JUN 09...	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV 06...	<.01	<.01	.05	<.01	<.01	<.01	<.01	.02	<.01	<.01	<.01

DATE	METH- OXY- CHLOR, TOTAL (UG/L)	METHYL PARA- THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRI- THION, TOTAL (UG/L)	PARA- THION, TOTAL (UG/L)	TOX- APHENE, TOTAL (UG/L)	TOTAL TRI- THION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 09...	.00	.00	.00	.00	.00	0	.00	.00	--	.00	.00
NOV 06...	<.01	<.01	<.01	<.01	<.01	0	<.01	.00	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:K-124

DATE 1980	SAMP- LING DEPTH (FT)	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH FIELD (UNITS)	TEMPER- ATURE, WATER (DEG C)	COLOR (PLAT- INUM COBALT UNITS)	NITRO- GEN, DIS- SOLVED (MG/L AS N)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD- NESS (MG/L AS CACO3)	HARD- NESS, NONCAR- BONATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MG/L AS CA)
JUN 13...	43.2	119	5.9	20.0	0	--	K60	K64	28	0	6.8
NOV 06...	43.0	130	6.5	20.0	2	.67	<1	<1	33	0	8.1

DATE 1980	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG)	SODIUM, DIS- SOLVED (MG/L AS NA)	POTAS- SIUM, DIS- SOLVED (MG/L AS K)	ALKA- LINITY (MG/L AS CACO3)	SULFATE DIS- SOLVED (MG/L AS SO4)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL)	FLUO- RIDE, DIS- SOLVED (MG/L AS F)	SILICA, DIS- SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N)
JUN 13...	2.7	11	1.2	39	1.0	8.2	.1	21	88	77	.17
NOV 06...	3.1	9.1	1.1	36	2.6	6.6	.0	22		76	--

DATE 1980	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N)	NITRO- GEN, TOTAL (MG/L AS N)	NITRO- GEN, TOTAL (MG/L AS NO3)	PHOS- PHORUS, TOTAL (MG/L AS P)	PHOS- PHORUS, TOTAL (MG/L AS PO4)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P)	ARSENIC DIS- SOLVED (UG/L AS AS)	BARIUM, DIS- SOLVED (UG/L AS BA)	CADMIUM DIS- SOLVED (UG/L AS CD)
JUN 13...	.07	1.7	--	1.9	8.3	.210	.64	--	3	70	2
NOV 06...	.14	--	.53	--	--	--	--	.010	--	--	--

DATE 1980	CHRO- MIUM, DIS- SOLVED (UG/L AS CR)	COPPER, DIS- SOLVED (UG/L AS CU)	IRON, TOTAL (UG/L AS FE)	IRON, DIS- SOLVED (UG/L AS FE)	LEAD, DIS- SOLVED (UG/L AS PB)	MANGA- NESE, TOTAL (UG/L AS MN)	MANGA- NESE, DIS- SOLVED (UG/L AS MN)	MERCURY DIS- SOLVED (UG/L AS HG)	NICKEL, DIS- SOLVED (UG/L AS NI)	SELE- NIUM, DIS- SOLVED (UG/L AS SE)	SILVER, DIS- SOLVED (UG/L AS AG)
JUN 13...	27	3	11000	240	0	310	260	.1	41	0	0
NOV 06...	2	0	--	1400	0	--	380	.1	19	--	0

DATE 1980	ZINC, DIS- SOLVED (UG/L AS ZN)	CYANIDE DIS- SOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PER- THANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPH- THA- LENES, POLY- CHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLOR- DANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
JUN 13...	140	--	0	.00	.1	.00	.00	.0	.00	.2	.00
NOV 06...	--	.00	10	--	--	<.01	<.10	<.1	<.01	.1	<.01

DATE 1980	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DI- AZINON, TOTAL (UG/L)	DI- ELDRIN TOTAL (UG/L)	ENDO- SULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTA- CHLOR, TOTAL (UG/L)	HEPTA- CHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALA- THION, TOTAL (UG/L)
JUN 13...	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV 06...	<.01	.01	.03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

DATE 1980	METH- OXY- CHLOR, TOTAL (UG/L)	METHYL PARA- THION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRI- THION, TOTAL (UG/L)	PARA- THION, TOTAL (UG/L)	TOX- APHENE, TOTAL (UG/L)	TOTAL TRI- THION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 13...	.00	.00	.00	.00	.00	0	.00	.00	--	.00	.00
NOV 06...	<.01	.02	<.01	<.01	<.01	0	<.01	.00	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:O-230

DATE 1980	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)
JUN 05...	30.7		7.0	24.5	140	--	K10	44	620	0	120
NOV 05...	30.0	5000	6.8	24.0	180	290	<1	<1	650	0	120

DATE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
JUN 05...	78	420	260	1950	5.5	530	.5	30	2620	.03
NOV 05...	84	400	220	1900	11	540	.4	37	2580	.07

DATE	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, TOTAL (MG/L AS NO3)	PHOSPHORUS, TOTAL (MG/L AS PO4)	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COPPER, DISSOLVED (UG/L AS CU)	IRON, TOTAL (UG/L AS FE)
JUN 05...	--	290	1300	10	--	44	2300	0	--	2	26000
NOV 05...	290	--	--	--	.250	68	3000	0	19	0	--

DATE	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, TOTAL (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)	CARBON, ORGANIC TOTAL (MG/L AS C)	CYANIDE DISSOLVED (MG/L AS CN)
JUN 05...	--	0	370	330	.2	6	0	0	20	120	--
NOV 05...	12000	3	--	380	<.1	10	0	0	20	140	.01

DATE	PHENOLS (UG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)
JUN 05...	12	.00	.2	.00	.30	.0	.00	.0	.00	.00
NOV 05...	2	--	--	<.01	<.10	<.1	<.01	1.1	<.01	<.01

DATE	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)
JUN 05...	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV 05...	<.01	<.01	.02	<.01	.06	<.01	<.01	.05	<.01	<.01

DATE	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 05...	.00	.00	.00	.00	.00	0	.00	--	--	--
NOV 05...	<.01	<.01	<.01	<.01	<.01	0	<.01	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:P-121

DATE 1980	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)
JUN 11...	24.1	2680	6.4	23.0	30	--	K3	1	530	0	110	61
NOV 05...	24.0	2500	6.2	25.0	35	45	<1	1	480	0	98	56

DATE	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
JUN 11...	270	50	660	4.5	400	.2	28	1370	1360	.00	.04
NOV 05...	250	41	670	2.7	390	.1	37	1440	1370	--	.05

DATE	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, TOTAL (MG/L AS NO3)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, TOTAL (MG/L AS PO4)	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)
JUN 11...	57	--	57	250	.150	.46	--	13	2500	0	23
NOV 05...	--	45	--	--	--	--	.030	12	2000	0	6

DATE	COPPER, DISSOLVED (UG/L AS CU)	IRON, TOTAL (UG/L AS FE)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, TOTAL (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)
JUN 11...	2	30000	25000	0	11000	11000	.6	63	0	0	70
NOV 05...	0	--	80000	0	--	14000	<.1	9	0	0	30

DATE	CARBON, ORGANIC TOTAL (MG/L AS C)	CYANIDE DISSOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
JUN 11...	57	.00	9	.40	.1	.00	.40	.0	.00	.2	.00
NOV 05...	64	.02	6	--	--	<.01	<.10	<.1	<.01	.3	<.01

DATE	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)
JUN 11...	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV 05...	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

DATE	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 11...	.00	.00	.00	.00	.00	0	.00	.00	--	.00	.00
NOV 05...	<.01	<.01	<.01	<.01	<.01	0	<.01	.00	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:P-122

DATE 1980	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)
JUN 04...	19.4	1050	6.8	16.5	2	--	<1	<1	320	0	71	34
NOV 04...	19.0	850	6.8	20.0	3	4.0	<1	K9	270	0	62	28

DATE	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
JUN 04...	80	5.1	360	90	45	.3	26	626	578	.02	.02
NOV 04...	66	4.9	303	100	45	.2	30	540	528	--	.00

DATE	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, TOTAL (MG/L AS NO3)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, TOTAL (MG/L AS PO4)	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)
JUN 04...	16	--	16	71	.480	1.5	--	4	90	9	17
NOV 04...	--	4.0	--	--	--	--	.250	3	80	3	8

DATE	COPPER, DISSOLVED (UG/L AS CU)	IRON, TOTAL (UG/L AS FE)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, TOTAL (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)
JUN 04...	0	8000	5700	0	5000	4500	<.1	1	0	0	4
NOV 04...	0	--	5600	3	--	4000	.2	1	0	0	0

DATE	CARBON, ORGANIC TOTAL (MG/L AS C)	CYANIDE DISSOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
JUN 04...	15	2.5	1	.20	.0	.00	.00	.0	.00	.0	.00
NOV 04...	13	2.5	1	--	--	<.01	<.10	<.1	<.01	.5	<.01

DATE	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)
JUN 04...	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV 04...	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

DATE	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 04...	.00	.00	.00	.00	.00	0	.00	--	--	--	--
NOV 04...	<.01	<.01	<.01	<.01	<.01	0	<.01	.00	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:P-123

DATE 1980	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)
JUN 03...	29.4	570	6.4	20.5	--	--	<1	<1	--	--	--
NOV 04...	29.0	510	6.3	20.0	2	1.0	<1	<1	150	0	30

DATE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)
JUN 03...	--	--	--	--	--	--	--	--	.02	--	.46
NOV 04...	17	39	2.3	42	24	.3	31	323	--	.16	--

DATE	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, TOTAL (MG/L AS NO3)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, TOTAL (MG/L AS PO4)	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COPPER, DISSOLVED (UG/L AS CU)
JUN 03...	--	.48	2.1	.300	.92	--	130	90	6	14	1
NOV 04...	.84	--	--	--	--	.020	110	90	4	30	0

DATE	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)	CARBON, ORGANIC TOTAL (MG/L AS C)	CYANIDE DISSOLVED (MG/L AS CN)	PHENOLS (UG/L)
JUN 03...	--	0	--	<.1	3	0	0	20	10	--	0
NOV 04...	15000	3	2300	<.1	3	0	0	3	22	.02	2

DATE	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)
JUN 03...	.00	.0	.00	.00	.0	.00	.0	.00	.00	.00
NOV 04...	--	--	<.01	<.10	<.1	<.01	1.5	<.01	<.01	.27

DATE	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	METHOXYCHLOR, TOTAL (UG/L)
JUN 03...	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NOV 04...	.02	.09	<.01	.25	<.01	.12	.04	<.01	<.01	<.01

DATE	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
JUN 03...	.00	.00	.00	.00	0	.00	.00	--	.00	.00
NOV 04...	<.01	.24	<.01	<.01	0	<.01	.00	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:P-126

DATE 1980	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)
NOV 03...	29.0	1900	6.8	20.0	70	61	>100000	37	360	0	100	27

DATE 1980	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)
NOV 03...	96	110	890	3.1	120	.1	33	1080	1040	.16	61

DATE 1980	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)
NOV 03...	.020	6	300	11	10	4	18000	3	660	.3	190

DATE 1980	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)	PHENOLS (UG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
NOV 03...	1	0	30	8	2.0	<.01	<.10	<.1	<.01	5.6	<.01

DATE 1980	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)
NOV 03...	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

DATE 1980	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
NOV 03...	<.01	<.01	<.01	<.01	<.01	0	<.01	.00	.00	.00	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:P-127

DATE 1980	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	HARDNESS, NONCARBONATE (MG/L CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)
NOV 03...	25.0	1000	6.8	19.5	10	9.5	<1	1	270	0	70	24

DATE	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)
NOV 03...	53	49	410	29	73	.3	26	609	581	.01	9.5

DATE	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)
NOV 03...	.020	5	400	5	3	4	7900	3	2600	<.1	4

DATE	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)	PHENOLS (UG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)
NOV 03...	1	0	0	7	2.0	<.01	<.10	<.1	<.01	1.7	<.01

DATE	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)
NOV 03...	<.01	<.01	<.01	<.01	<.01	.15	<.01	<.01	.11	<.01	<.01

DATE	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
NOV 03...	<.01	<.01	.16	<.01	<.01	0	<.01	.00	.00	.14	.00

Table 3.--Water-quality data from observation wells in the shallow aquifer at selected waste-disposal sites--Continued

WELL SH:U-39

DATE 1981	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARDNESS (MG/L AS CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
JUL 09...	53.6	550	6.5	17.0	3	.58	<1	K2	270	59	30	13

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N)	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)
JUL 09...	2.0	290	13	9.1	.2	16	316	317	.01	.57	.010	2

DATE	BARIUM, DISSOLVED (UG/L AS BA)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)
JUL 09...	200	<1	3	3	160	3	80	<.1	6	2	0	4

DATE	CYANIDE DISSOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)
JUL 09...	<.01	0	.00	.0	<.01	<.10	<.1	<.01	.1	<.01	<.01

DATE	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	METHOXYCHLOR, TOTAL (UG/L)
JUL 09...	<.01	<.01	<.01	<.01	1.0	<.01	<.01	<.01	<.01	<.01	<.01

DATE	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)	RDX TOTAL (UG/L)
JUL 09...	<.01	1.0	<.01	<.01	1	<.01	<.01	<.01	<.01	<.10	.00

DATE	CONFIRMATION ABOVE 2 (UG/L)	TNT, TOTAL (WATER UG/L)	2-AMINO 4,6-DNT, TOTAL (UG/L)	4-AMINO 2.6-DNT, TOTAL (UG/L)
JUL 09	0	0.00	0.0	0.0

WELL SH:U-40

DATE 1981	SAMPLING DEPTH (FT)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH FIELD (UNITS)	TEMPERATURE, WATER (DEG C)	COLOR (PLATINUM COBALT UNITS)	NITROGEN, DISSOLVED (MG/L AS N)	HARDNESS (MG/L AS CACO3)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)
JUL 24...	60.0	375	6.7	21.0	0	.92	200	45	22	10	2.4

DATE 1981	ALKALINITY (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC DIS. (MG/L AS N)	PHOSPHORUS, DISSOLVED (MG/L AS P)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
JUL 24...	200	12	23	.2	12	236	.06	.86	.020	2	300

DATE 1981	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	ZINC, DISSOLVED (UG/L AS ZN)
JUL 24...	18	10	15	20	2	180	<.1	23	0	0	1300

DATE 1981	CYANIDE DISSOLVED (MG/L AS CN)	PHENOLS (UG/L)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)	TANNIN AND LIGNIN (MG/L)	PERTHANE TOTAL (UG/L)	PCB TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)
JUL 24...	<.01	0	.00	.0	<.01	.20	<.1	<.01	<.1	<.01	<.01

DATE 1981	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	METHOXYCHLOR, TOTAL (UG/L)
JUL 24...	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

DATE 1981	METHYL PARATHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)	RDX TOTAL (UG/L)
JUL 24...	<.01	<.01	<.01	<.01	0	<.01	<.01	<.01	<.01	<.01	.00

DATE 1981	CONFIRMATION ABOVE 2 (UG/L)	TNT, TOTAL (WATER UG/L)	2-AMINO 4,6-DNT, TOTAL (UG/L)	4-AMINO 2.6-DNT, TOTAL (UG/L)
JUL 24	0	0.00	0.0	0.0

REFERENCES

Bell, E. A., and Nyman, D. J., 1968, Flow pattern and related chemical quality of ground water in the "500-foot" sand in the Memphis area, Tennessee: U.S. Geological Survey Water-Supply Paper 1853, 27 p.

Criner, J. H., Sun, P-C. P., and Nyman, D. J., 1964, Hydrology of aquifer systems in the Memphis area, Tennessee: U.S. Geological Survey Water-Supply Paper 1779-O, 54 p.

Graham, D. D., 1979, Potentiometric map of the Memphis Sand in the Memphis area, Tennessee, August 1978; U.S. Geological Survey Water Resources Investigation 79-80, scale 1:125,000, 1 sheet.

Parks, W. S., Graham, D. D., and Lowery, J. F., 1981, Chemical character of ground water in the shallow water-table aquifer at selected localities in the Memphis Area, Tennessee: U.S. Geological Survey Open-File Report 81-223, 29 p.

Parks, W. S., and Lounsbury, R. W., 1976, Summary of some current and possible future environmental problems related to geology and hydrology at Memphis, Tennessee: U.S. Geological Survey Water-Resources Investigation 4-76, 34 p.

Waste Age, 1979, Hit list, part two: v. 10, no. 8, p. 53, 54, 56, 58.